

5.1 Linear Models
p.268- 281

CBR Movement D-TGraphs

Describe the Path of Movement

Example 1 p.270
Reading Values of a Graph

Buying Electricity
Electrical energy is sold in units called kilowatt-hours (kWh). Shelley operates a horse-boarding stable. The graph shows the monthly cost for the electricity consumed to operate the stable.

a) Describe the relationship between monthly cost and energy consumed.

b) Use the graph to estimate the cost of 200 kWh.

c) By how much does the cost increase for 300 kWh for 400 kWh?

d) How does the cost change each time the consumption goes up by 100 kWh?

e) Consider the rate of change of cost with respect to consumption. What are suitable units for this rate of change?

f) Is the rate of change of cost with respect to consumption increasing, constant, or decreasing? Justify your answer.

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ii) Graphing Linear Relationships

Example 2 using TI83 p. 271

Fuel Consumption in an Aircraft

The Diamond Katana is a popular training aircraft manufactured in London, Ontario. The capacity of the fuel tank is 19.5 gal. The table shows the amount of fuel remaining in the tank during a flight.

Time (h)	Fuel Remaining (gal)
0.00	19.50
0.25	18.70
0.50	17.90
0.75	17.10
1.00	16.30
1.25	15.40
1.50	14.60
1.75	13.80
2.00	13.00
2.25	12.20
2.50	11.40
2.75	10.60
3.00	9.80



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2.50	11.40
2.75	10.60
3.00	9.80



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- Draw a graph, with time on the horizontal axis and fuel remaining on the vertical axis.
- Describe the shape of the graph.
- How much fuel was consumed during the first hour of flight? the second hour? the third hour? Does the rate of change appear to be increasing, constant, or decreasing?
- What is a reasonable estimate for the rate of change of fuel remaining in the tank? Include suitable units for this rate of change.
- Determine the length of time that the aircraft can be flown on one tank of fuel.

$$\begin{aligned}
 & -0.80 / 0.25 \text{ hr} \\
 & -3.2 \text{ gal/hr} \\
 & y = mx + b \\
 & y = -3.2x + b \\
 & y = -3.2x + 19.5 \\
 & \text{empty tank } y = 0 \\
 & 0 = -3.2x + 19.5 \\
 & -19.5 = -3.2x \\
 & \frac{-19.5}{-3.2} = x \\
 & 6.09 = x
 \end{aligned}$$

The plane can fly 6.09 hr on a tank of fuel.

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- Draw a graph, with time on the horizontal axis and fuel remaining on the vertical axis.
- Describe the shape of the graph.
- How much fuel was consumed during the first hour of flight? the second hour? the third hour? Does the rate of change appear to be increasing, constant, or decreasing?
- What is a reasonable estimate for the rate of change of fuel remaining in the tank? Include suitable units for this rate of change.
- Determine the length of time that the aircraft can be flown on one tank of fuel.

$$\begin{aligned}
 & y = mx + b \\
 & y = -3.2x + 19.5 \\
 & 0 = -3.2x + 19.5 \\
 & -19.5 = -3.2x \\
 & \frac{-19.5}{-3.2} = x \\
 & 6.09 = x \\
 & 6 \text{ hr} = x
 \end{aligned}$$

0.09 x 60 = 5 min

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iii) Line of Best Fit

Example 3 p. 273

Canadian Coffee Consumption

The table shows the yearly average Canadian per capita coffee consumption, in litres, over 30 years.

Year	Consumption (L)	Year	Consumption (L)	Year	Consumption (L)
1978	91	1988	92	1998	96
1979	93	1989	90	1999	99
1980	97	1990	96	2000	101
1981	102	1991	97	2001	102
1982	94	1992	88	2002	104
1983	91	1993	92	2003	105
1984	93	1994	99	2004	106
1985	97	1995	96	2005	102
1986	91	1996	97	2006	101
1987	90	1997	94	2007	104

Source: Statistics Canada, CANSIM Table 002-0011, Database: E-STAY

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- a) Examine the values in the table. Predict whether the trend in coffee consumption is increasing, constant, or decreasing. Give a reason for your prediction. Does the rate of change appear to be constant?
- b) Let 1978 be year 0. Create a scatter plot with the year on the horizontal axis and consumption on the vertical axis. Use linear regression to add a line of best fit to your graph. Write an equation for the line.
- c) Does the line of best fit support your prediction in part a)?
- d) Use the line of best fit to determine the average rate of change of coffee consumption. What are the units for this rate of change?
- e) Predict the coffee consumption in 2018 using two different methods.

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Key Concepts

- *when pts on a graph create a straight line- Linear*
- *Linear Relationship* - equal changes over equal intervals
- first differences are constant
- *Rate of Change* - positive - quantity is increasing
- negative - quantity is decreasing
- 0- quantity is constant **plateau**
- *Line of Best Fit - used interpolate and extrapolate -predictions*

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Hmk. p. 275 -281
q. 5,6,8,9 & 12

Mar 8-7:37 AM